REMARKS

Claims 1-7 and 10-11 are present in the application and have been finally rejected as being obvious over the combination of Reinalda et al. in view of Khare et al. and Wolff-Doring et al. The first two references are said to teach a process for the preparation of zirconia-based catalysts and the third reference is said to teach the value of monoclinic zirconium having a large surface area in zirconia-based catalysts. These rejections are respectfully traversed.

The invention relates to a process for preparing a calcined zirconia extrudate comprising zirconium and one or more elements selected from Groups IB, IIB, IIIB, IVB, VB, VIB, VIIB and VIII of the Periodic Table of Elements and lanthanides and actinides. The process involves preparing a shapeable dough by mixing and kneading a particulate zirconia and a source of one or more of the above elements with a solvent to obtain a mixture having a total solids content of from about 50 to about 85 percent by weight, extruding the shapeable dough to form a zirconia extrudate comprising zirconium and one or more of the above elements, and then drying and calcining zirconia extrudate. It is important that the particulate zirconia comprise no more than about 15 percent by weight of zirconia which is other than monoclinic zirconia.

The invention also relates to such a process wherein a cobalt precursor is mixed in with the particulate zirconia as the shapeable dough is prepared. The invention also relates to a process wherein a liquid cobalt precursor is impregnated into the zirconia extrudate prior to drying and calcining.

The benefits of the calcined zirconia extrudates prepared according to the processes of the present invention are that they have a surprisingly high radial crush strength while benefiting from the advantages of the high rate of production and high pore volume associated with extrudates. Shaped zirconia particles are known for use as catalyst carriers and catalysts for certain processes. Common methods of forming shaped zirconia particles include extrusion, roll-pressing and tableting. Once formed, these shaped particles are commonly dried and then calcined in order to create porosity as well as to increase the particles' crush strength. Both of these characteristics are especially important in catalytic applications.

Extrusion processes are often preferred over tableting processes since the rate of production for extrusion processes is many orders of magnitude greater than for tableting. Tableting also tends to result in lower pore volumes which is often a limitation in catalytic applications. Furthermore, extrusion processes are often preferred over roll-pressing processes because the granules formed in roll-pressing processes typically have a broad particle size distribution which is often undesirable in catalytic applications because it enhances segregation in a packed bed of catalyst particles.

Even though, as explained above, extrudates are preferred over other types of shaped particles, it has not always been possible to form calcined zirconia extrudates using conventional extrusion equipment to make extrudates which have sufficient strength to be of industrial importance. The Applicants have surprisingly found that by using particulate zirconia which comprises no more than 15 percent by weight of zirconia which is other than monoclinic zirconia, calcined zirconia extrudates sufficient crush strength to be of industrial importance can be produced using conventional extrusion equipment.

Wolff-Doring is directed to a process for the preparation of zirconium dioxide which is at least 80 percent by weight monoclinic and which has a surface area of at least 100 m^2/g (claim 1). There is no teaching in this reference of the problems associated with producing zirconia extrudates using conventional extrusion equipment wherein the extrudates have sufficient crush strengths to be of industrial importance. Indeed, there is no mention of crush strength is this document at all.

In order to arrive at the process of the present invention when starting from the teachings of Wolff-Doring, the person of ordinary skill in the art would have to:

(a) choose to make molded articles from zirconia powder (making any form of molded article is mentioned in this reference only as optional--column 3, lines 51-53);

(b) choose that the molded articles should be extrudates (this is presented as one option in a <u>long</u> list of possibilities (column 3, lines 59-62);

(c) choose to incorporate a metal into the extrudate (again, this is presented in the reference only as an <u>option</u>--the zirconia dioxides are taught as suitable for catalysts as well as catalyst supports); and

(d) choose to effect the incorporation of the metal by mixing and kneading the metal with the shapeable dough prior to extrusion (although methods for the incorporation of metals are listed in the reference--column 4, lines 21-24--this method is <u>not</u> listed as suitable; further it is well-known in the art that the way a catalyst is produced will affect its structure and thus its activity; thus, a skilled person would be taught against choosing a method that was not listed as suitable).

There is no incentive in the reference for the skilled person to choose and combine all of these steps (none of which are exemplified or even taught as preferred) in order to achieve the aim of the present invention (on which this reference is silent). Thus, the Applicants assert that the present invention is nonobvious over the teachings of Wolff-Doring.

In moving to Khare et al., the Examiner states that it would be obvious to carry out the present invention over the teachings of a combination of Reinalda et al. and Khare et al. However, the Applicants assert that the present claims are nonobvious over the combination of these references for the following reasons.

Khare et al. relates to a process for the preparation of a zirconia-based catalyst or catalyst precursor which is prepared by a process comprising mulling a mixture of zirconia and/or a zirconia precursor in a solvent, wherein the mixture has a solids content of 20-60 percent by weight, and extruding the mixture. The zirconia extrudates formed in Khare et al. may optionally be impregnated with a catalytically active element. However, Khare et al. does not disclose whether the zirconia used is in the monoclinic form. In fact, this reference makes no reference at all of the type of crystal structure of the zirconia particles used in the preparation of the zirconia extrudates. Furthermore, nowhere within Khare et al. does it hint or suggest the advantages of using particulate zirconia comprising no more than 15 percent by weight of zirconia which is other than monoclinic zirconia for the preparation of zirconia extrudates, <u>in particular in terms of increased crush strength</u>.

The general teaching of Reinalda et al. is of using <u>any</u> zirconia powder in the preparation of shaped zirconia particles. There is no teaching in Reinalda et al. that the type of crystal structure of the zirconia particles used would affect the crush strength of the formed particles. Indeed, in the examples of this reference, the crush strength is shown to vary depending on the method of making the shaped particles and <u>not</u> on the zirconia used. Therefore, Reinalda et al. would provide no incentive to use monoclinic zirconia in the process of Khare et al. in order to improve the crush strength of the formed particles.

The person of ordinary skill in the art would have had no incentive to carry out the process of the present invention in light of the combined teachings of Reinalda et al. and Khare et al., even combined with the teachings of Wolff-Doring, and the present invention is, therefore, nonobvious over the teachings of these references. The Applicants assert that the rejection has been overcome and respectfully requests an early notice of allowance.

Respectfully submitted,

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